

Applicant: R.Susil, et al.
U.S.S.N. : 09/663,989
RESPONSE TO FINAL OFFICE ACTION
Page 3 of 21

Amendments to the Claims

This listing of claims will replace all prior versions, and listing, of claims in the application.

Listing of Claims:

1. (Previously Presented) An imaging system for invasive therapy of a patient, the system comprising:

an imaging apparatus that can provide a cross-sectional image of a patient;
a medical instrument comprising a fiducial object that can be simultaneously imaged in the same image as a targeted site of the patient.

2. (Original) The system of claim 1 wherein the fiducial object representation in the image is unique for the pose of the instrument within the therapeutic field or range of motion of the instrument.

3. (Original) The system of claim 1 or 2 wherein the image can produce three identifiable points to coordinate pose of the instrument and the targeted site of the patient.

4. (Previously Presented) The system of claim 1 wherein the instrument pose is directly manipulated in reference to the medical image.

Applicant: R.Susil, et al.
U.S.S.N. : 09/663,989
RESPONSE TO FINAL OFFICE ACTION
Page 4 of 21

5. (Previously Presented) The system of claim 1 wherein the relative position and orientation of the medical instrument and target site of the patient can be determined from the information contained in a single cross-sectional image produced by the imaging apparatus.

6. (Previously Presented) The system of claim 1 wherein the system comprises a control apparatus that can register the instrument in a detected image space and calculate instrument movement.

7. (Previously Presented) The system of claim 6 wherein the control apparatus calculates the instrument pose in the image space by generating at least three corresponding points.

8. (Previously Presented) The system of claim 1 wherein the fiducial object comprises three N-shaped fiducial motifs, and the three N-shaped fiducial motifs are non-coplanar.

9. (Original) The system of claim 8 wherein the three N-shaped fiducial motifs are arranged orthogonally in a U- shape with one fiducial motif forming the bottom and two fiducial motifs forming the sides.

10. (Previously Presented) The system of claim 1 wherein the medical instrument is manipulated manually.

Applicant: R.Susil, et al.

U.S.S.N. : 09/663,989

RESPONSE TO FINAL OFFICE ACTION

Page 5 of 21

11. (Currently Amended) The system of claim 1, any one of claims 1 through 10 wherein the system further comprises a robotic apparatus capable of positioning the medical instrument.

12. (Original) The system of claim 11 wherein the instrument is positioned by the robot in the desired pose relative to the patient.

13. (Previously Presented) The system of claim 1 wherein the imaging device is a CT, MRI or ultrasound device.

14. (Previously Presented) The system of claim 1 wherein the fiducial object is affixed to the instrument.

15. (Previously Presented) The system of claim 14 wherein the fiducial object is integral to the instrument.

16. (Previously Presented) A method for guiding invasive therapy in a patient, comprising:

- a) providing a system that comprises an imaging apparatus and a medical instrument comprising a fiducial object that can be simultaneously imaged in the same image as a targeted site of the patient;
- b) obtaining a cross-sectional image that comprises both the fiducial object and the targeted site of the patient; and

Applicant: R.Susil, et al.

U.S.S.N. : 09/663,989

RESPONSE TO FINAL OFFICE ACTION

Page 6 of 21

c) manipulating the instrument with respect to the patient using information derived from the image.

17. (Original) The method of claim 16 wherein the relative position and orientation of the medical instrument and target site of the patient are determined from the information contained in a single cross-sectional image.

18. (Original) The method of claim 16 or 17 wherein the instrument is manipulated using information derived from a single reference frame of the relative position of the instrument and target site.

19. (Previously Presented) The method of claim 16 wherein the instrument is manipulated substantially contemporaneously with respect to obtaining the image.

20. (Previously Presented) The method of claim 16 wherein the instrument is manipulated based on a single image.

21. (Previously Presented) The method of claim 16 wherein a plurality of images are obtained.

Applicant: R.Susil, et al.
U.S.S.N. : 09/663,989
RESPONSE TO FINAL OFFICE ACTION
Page 7 of 21

22. (Original) The method of claim 21 wherein the plurality of images are taken over a period of at least one minute.

23. (Original) The method of claim 21 or 22 wherein one or more volumetric images are obtained.

24. (Previously Presented) The method of claim 16 wherein a material is deposited or administered to the patient by the instrument.

25. (Original) The method of claim 24 wherein the administered or deposited material is a therapeutic agent.

26. (Previously Presented) The method of claim 16 wherein energy is administered to the patient.

27. (Previously Presented) The method of claim 16 wherein energy is removed from the patient.

28. (Previously Presented) The method of claim 16 wherein tissue is removed from the patient by the instrument.

Applicant: R.Susil, et al.
U.S.S.N. : 09/663,989
RESPONSE TO FINAL OFFICE ACTION
Page 8 of 21

29. (Previously Presented) The method of claim 16 wherein the instrument administers to the patient a radiation seed implant, a DNA therapeutic, a chemotherapeutic agent, a cryotherapeutic treatment, a sclerotic solution, ethanol, high intensity ultrasound, directed beam therapy, localized X-ray therapy, photodynamic therapy, laser ablation therapy, or RF ablation therapy.

30. (Previously Presented) The method of claim 16 wherein the fiducial object representation in the image is unique for the pose of the instrument.

31. (Previously Presented) The method of claim 16 wherein the image can produce three identifiable points to coordinate pose of the instrument and the targeted site of the patient.

32. (Previously Presented) The method of claim 16 wherein the instrument pose is directly manipulated in reference to the medical image.

33. (Previously Presented) The method of claim 16 wherein the instrument is registered in detected image space by a control apparatus.

34. (Original) The method of claim 33 wherein the instrument is registered in the image space by the image generating at least three corresponding points.

Applicant: R.Susil, et al.

U.S.S.N. : 09/663,989

RESPONSE TO FINAL OFFICE ACTION

Page 9 of 21

35. (Previously Presented) The method of claim 16 wherein the fiducial object comprises three N-shaped fiducial motifs, and the three fiducial motifs are non-coplanar.

36. (Original) The method of claim 35 wherein the three N-shaped fiducial motifs are arranged orthogonally in a U-shape with one fiducial motif forming the bottom and two fiducial motifs forming the sides.

37. (Previously Presented) The method of claim 16 wherein the medical instrument is manipulated manually.

38. (Previously Presented) The method of claim 16 wherein the instrument is manipulated by a robotic apparatus.

39. (Previously Presented) The method of claim 16 wherein the imaging device is a CT, MRI or ultrasound device.

40. (Previously Presented) An imaging system for invasive therapy of a patient, the system comprising:
an imaging apparatus that can provide a cross-sectional image of a patient;

Applicant: R.Susil, et al.
U.S.S.N. : 09/663,989
RESPONSE TO FINAL OFFICE ACTION
Page 10 of 21

a medical instrument comprising a fiducial object that can be simultaneously imaged in the same cross-sectional image as a targeted site of the patient, the image producing three identifiable points to coordinate pose of the instrument and the targeted site of the patient; and
a control apparatus that can register the instrument in detected image space and calculate instrument movement.

41. (Previously Presented) A method for guiding invasive therapy in a patient, comprising:
- a) providing a system that comprises i) an imaging apparatus, ii) a medical instrument comprising an associated fiducial object that can be simultaneously imaged in the same cross-sectional image as a targeted site of the patient, and iii) a control apparatus that can, via input from the imaging apparatus, register the instrument in detected image space and calculate instrument movement;
 - b) obtaining a cross-sectional image that comprises both the fiducial object and the targeted site of the patient, the image producing three identifiable points to coordinate pose of the instrument and the targeted site of the patient; and
 - c) based on input from the control apparatus, manipulating the instrument with respect to the patient using information derived from the image.

Applicant: R.Susil, et al.
U.S.S.N. : 09/663,989
RESPONSE TO FINAL OFFICE ACTION
Page 11 of 21

42. (Previously Presented) A method for guiding invasive therapy in a patient, comprising:
- a) providing a system that comprises i) an imaging apparatus, ii) a medical instrument comprising an associated fiducial object that can be simultaneously imaged in the same cross-sectional image as a targeted site of the patient;
 - b) obtaining a cross-sectional image that comprises both the fiducial object and the targeted site of the patient, a single image providing information sufficient to coordinate pose of the instrument and the targeted site of the patient; and
 - c) manipulating the instrument with respect to the patient using information derived from a single cross-sectional image.

43. (Previously Presented) An imaging system for invasive therapy of a patient, the system comprising:
- an imaging apparatus that can provide a cross-sectional image of a patient;
- a medical instrument comprising a fiducial object that can be imaged in the same image as a targeted site of the patient; and
- wherein the fiducial object comprises three N-shaped fiducial motifs, and the three N-shaped fiducial motifs are non-coplanar.

44. (Previously Presented) A method for guiding invasive therapy in a patient, comprising:
- a) providing a system that comprises an imaging apparatus and a medical instrument comprising a fiducial object that can be imaged in the same image as a targeted site of the patient,

Applicant: R.Susil, et al.
U.S.S.N. : 09/663,989
RESPONSE TO FINAL OFFICE ACTION
Page 12 of 21

the fiducial object including three N-shaped fiducial motifs, where the three fiducial motifs are non-coplanar;

- b) obtaining a cross-sectional image that comprises both the fiducial object and the targeted site of the patient; and
- c) manipulating the instrument with respect to the patient using information derived from the image.